Make your own Morse Buzzer

Detailed simple instructions and a super-size fold-out plan

35p

A WOLFE **FOLDAPLAN** BOOK

Make Your Own

Morse Buzzer

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Illustrated by Andrew Calder

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Notes on Soldering

For soldering electrical joints you should use only an electric soldering iron and resin-cored solder.

The two most important things about making a good soldered joint are a *hot iron* and *clean* or 'tinned' surfaces to be joined. Leads on radio components are already tinned. But even a tinned surface will not solder properly if it is dirty or greasy. If in doubt, scrape the surface clean with a knife, or rub with emery paper. Where enamelled wire is used for connections, clean the ends by scraping off the enamel to expose bright copper.

Follow this procedure in making a joint:

(*i*) *Plug in and switch on the iron and leave for a minute or two to warm up to full heat. Check by touching the tip with solder. The solder should melt immediately and run over the tip. If the solder drops off the tip, then the* iron *is dirty and the tip needs cleaning with emery paper.*

(*ii*) *Bring the tip of the iron into contact with the joint. Wait a second or so for the heat from the iron to heat up the joint.*

(*iii*) *Touch the joint with solder. The solder should melt at once and run over the joint.*

(*iv*) *Remove the iron at once so that no more heat is applied to the joint than necessary.*

Two things can go wrong at stage (iii):

(*a*) *The solder does not melt. Then the joint is not hot enough. Either the iron is not hot enough (or too small for the job), or it has not been held against the joint for a long enough period.*

(*b*) *The solder melts but falls off the joint. In this case the joint is 'dirty' and needs cleaning before attempting to resolder.*

A good soldered joint is 'bright clean', with the solder flowing evenly over the whole of the joint area.

A 'dry' joint is where the solder sets in a rough, crystalline form. This is usually caused by not enough heat, but it can be due also to a dirty joint with too much solder applied in an attempt to complete the joint.

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How to make a Morse Buzzer

There are two separate parts to a Morse buzzer—a *key* and a *buzzer unit.* The *key* works as an on-off switch for producing the buzzer signals. It needs to be a special kind of switch—not a press-button or ordinary switch—to produce crisp and accurate Morse messages—and should always be a separate unit from the buzzer.

The *buzzer* can be an electro-mechanical type, working like an electric bell without the 'ring'; or an electronic buzzer. Constructional details of both types are given. The mechanical-type buzzer can be used for ordinary listening, or listening through headphones. Electronic buzzers produce signals which can only be heard through headphones, or a loudspeaker.

Making the Key

The key needs to be mounted on a solid, heavy base. This should be cut from $\frac{3}{4}$in. thick ply wood (or solid wood of similar thickness), in the shape of a rectangle 6in. by 4in. Plan Sheet Diagram 1 shows this shape full size, and also the position of the four holes which have to be drilled in it.

Carefully mark the position of the three holes shown as solid black circles. Drill these with a 4mm drill, taking great care to keep the drill dead upright so that the holes are square to the top and bottom faces of the base, not angled to one side.

Next step is to make the actual key. This is a 5in. length cut from $\frac{3}{8}$in. wide 16 gauge ($\frac{1}{16}$in. thick) *hard* brass strip, using a hacksaw. Mark the two hole positions as shown in Plan Sheet Diagram 2 and drill these with the 4mm drill.

Lay the key strip on the base and use one of the 4BA screws to locate the end hole in the strip over the end hole in the base, as shown in Fig. 1. Make sure that the strip is parallel to the edge of the base. With a pencil, mark the position of the second hole, as shown. The strip can then be removed and this hole drilled in the base.

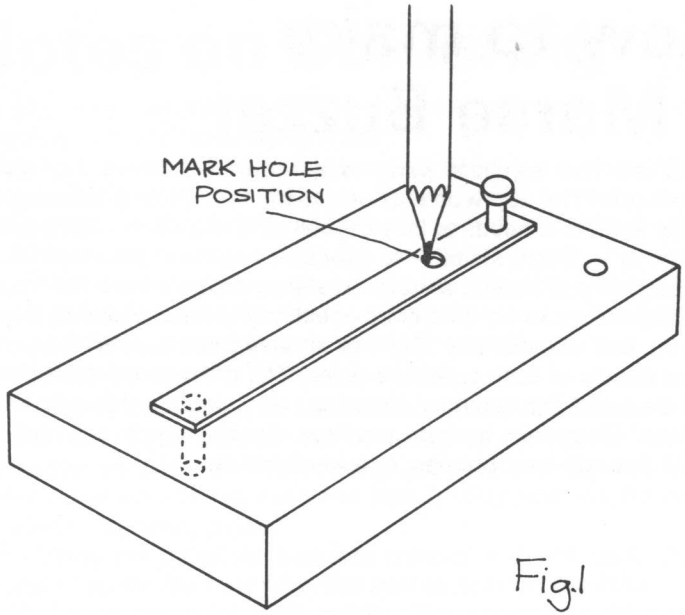


Fig.1

The key strip is then given two shallow bends, using flat-nosed pliers, to form to the shape shown on Plan Sheet Diagram 2. Adjust the bends carefully so that when the end of the strip with the holes in is laid on a flat surface the other end lies parallel to the surface but $\frac{1}{4}$in. above it.

Now refer to Plan Sheet Diagram 3. Put one 4BA screw through hole A in the base, securing with a nut on the underside. Assemble the key strip to the base with two more 4BA screws at B and C, using a long ($1\frac{1}{4}$in.) screw in the end hole (C). Both these screws are fitted with the heads on the underside of the base. Fit the other long screw (again head on the underside of the base) through hole D. Run an extra nut on each of the screws at position C and D. These are the terminals of the key.

Turn the assembly upside down, slacken off the nuts on screws A and D and connect a length of wire between these two points as shown in Fig. 2. Tighten up the nuts again to ensure good connection. Then glue on two strips of balsa to the bottom edges of the base, as shown. These act as 'feet' to allow the key to stand flat on a table or other level surface.

To complete the key you need to add a knob to the end of the key strip. This can be a plastic button or counter of about 1in. diameter. Simply glue to the end of the key strip with 'five-minute' epoxy adhesive, as shown in Fig. 3.

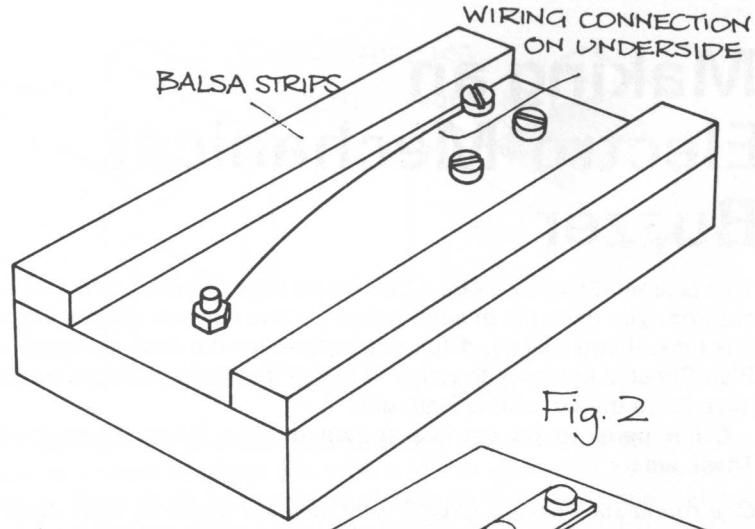


Fig.2

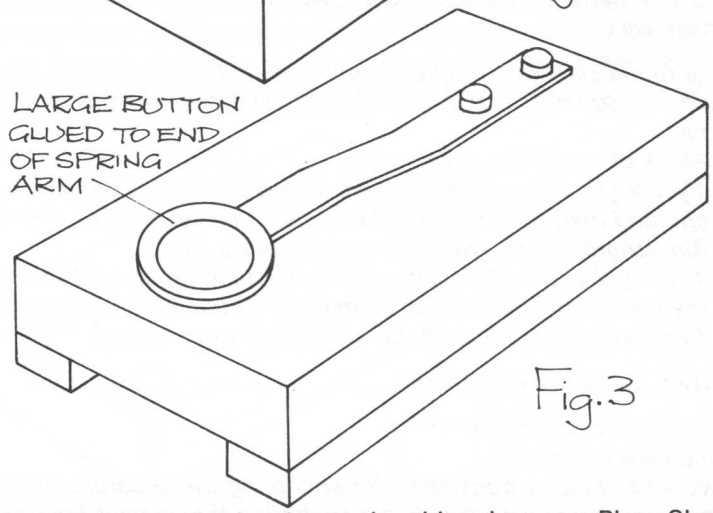


Fig.3

The complete key is shown in side view on Plan Sheet Diagram 4. The key is operated by tapping the knob on the end of the key strip, so that its downward movement makes contact with screw A (the key 'contact'). Remember, screws C and D are the terminal points for connecting the key to the buzzer circuit.

FOR THE KEY YOU WILL NEED:

Base piece 6in. × 4in. × $\frac{3}{4}$in. thick ply or solid wood
5in. length of $\frac{3}{8}$in. × 16 gauge hard brass strip
Two 4BA brass screws 1in. long
Two 4BA screws $1\frac{1}{4}$in. long
Six 4BA brass nuts
Large plastic button (or similar).

Making an Electro-Mechanical Buzzer

This is assembled on a 4in. × 3in. wood base, which again can be cut from $\frac{3}{4}$in. thick ply or solid wood (or you can use thinner wood this time, if you prefer). A full size pattern for the base is shown in Plan Sheet Diagram 5, together with the four hole positions which have to be drilled with a 3mm drill.

Other parts to be cut are shown in Plan Sheet Diagram 6. These are:

One round six-inch (or larger) wire nail, cut down to $1\frac{1}{2}$in. long
Two 1in. squares of thin ply, drilled through the centre to fit the nail
A block of wood 1in. × 1in. × $\frac{1}{2}$in.
A $1\frac{1}{2}$in. × $\frac{1}{2}$in. piece of brass sheet, drilled with a 3mm hole at each end and then bent into a right-angled 'bracket' shape
A 3in. length of $\frac{1}{4}$in. wide thin springy *brass strip*
A 1in. × $\frac{1}{2}$in. piece of tinplate, cut from an old tin can. (Check that the can is *tinplate and not aluminium by testing with a magnet. Tinplate will be attracted; an aluminium can will not)*

Other parts required are:

Five 6BA brass screws
Nine 6BA brass nuts
Two small brass woodscrews for anchoring the armature spring
One larger brass woodscrew for anchoring the contact bracket
A generous length of enamelled copper wire for making the coil winding.

To make the coil, fit the two 1in. square ply cheeks to the cut down nail, as shown in Fig. 4. The cheeks should be a tight fit on the nail. Wind on turns of the enamelled wire, layer on layer, until you have nearly filled all the space available between the cheeks. The size of wire used is not important, but the more turns you can get on to the coil the better. Having completed the winding you can hold it in place with a wrapping of insulating tape, or pull the wire ends taut through small holes drilled in each coil cheek, as shown.

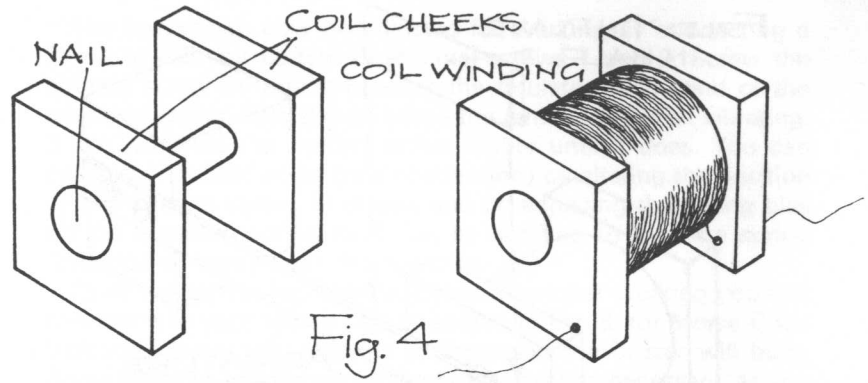


Fig. 4

Take the base and turn upside down. *Counterbore* each drilled hole to a depth of about $\frac{3}{8}$in. with a $\frac{1}{8}$in. or $\frac{5}{32}$in. drill, as shown in Fig. 5. Then fit all four terminal screws so that they project about $\frac{3}{8}$in. from the top of the base (also refer to Plan Sheet Diagram 7A).

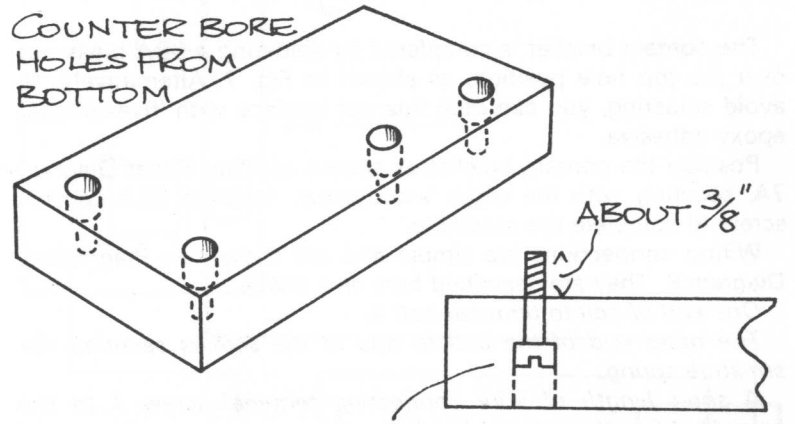


Fig. 5

The coil is now glued on to the base, by the two cheeks, in the position shown in Plan Sheet Diagram 7B. The armature spring is then aligned so that when screwed to its fixing block it lines up with the nail head forming the 'core' of the coil, leaving a gap of about $\frac{1}{16}$in. (refer to Plan Sheet Diagram 7B and Fig. 6).

Complete the armature assembly by folding the tinstrip piece in half and then crimping over the end of the armature spring, as shown in Fig. 6.

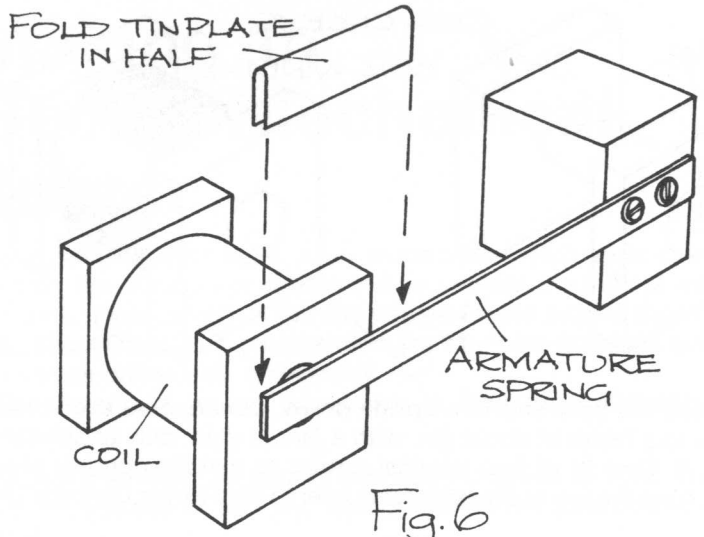


Fig. 6

The contact bracket is completed by soldering a 6BA brass nut over the top hole position, as shown in Fig. 7. Alternatively, to avoid soldering, you can glue this nut in place with 'five-minute' epoxy adhesive.

Position the contact bracket as shown on Plan Sheet Diagram 7A, securing with the larger woodscrew. Add the 6BA contact screw to complete the assembly.

Wiring connections are simple and are shown on Plan Sheet Diagram 8. They are described here as a check.

One end of coil to terminal bolt 2.

The other end of the coil to one of the screws securing the armature spring.

A short length of wire connecting terminal screw 1 to the screw holding the contact bracket.

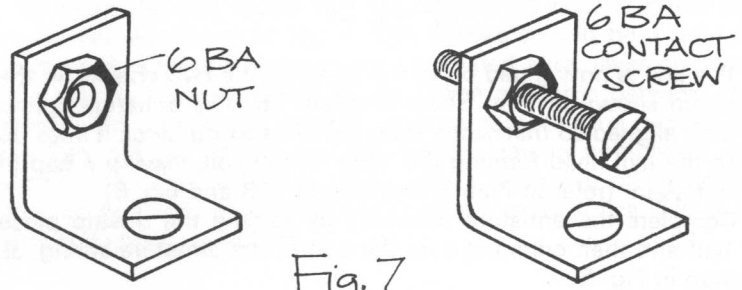


Fig. 7

The buzzer can now be adjusted for working by connecting a 3 volt or 4·5 volt battery to terminal screws 1 and 2. Screw the contact screw in until it touches the tinplate on the end of the armature spring. This should cause the armature to start vibrating. If not, advance the contact screw farther until it does. You can adjust the 'buzzer' noise (rate of vibration) by altering the position on the contact screw, in or out, and by adjusting the spring bias on the armature spring itself, i.e. by bending to bias the spring 'towards' or 'away from' the coil core.

Once the buzzer has been adjusted for proper working you can connect it to your Morse Key, as shown in Fig. 8, for Morse Code 'sending'. Every time the key is depressed the buzzer will buzz. Some slight re-adjustment of the buzzer may be necessary, as you gain proficiency, to match its response to your speed of sending.

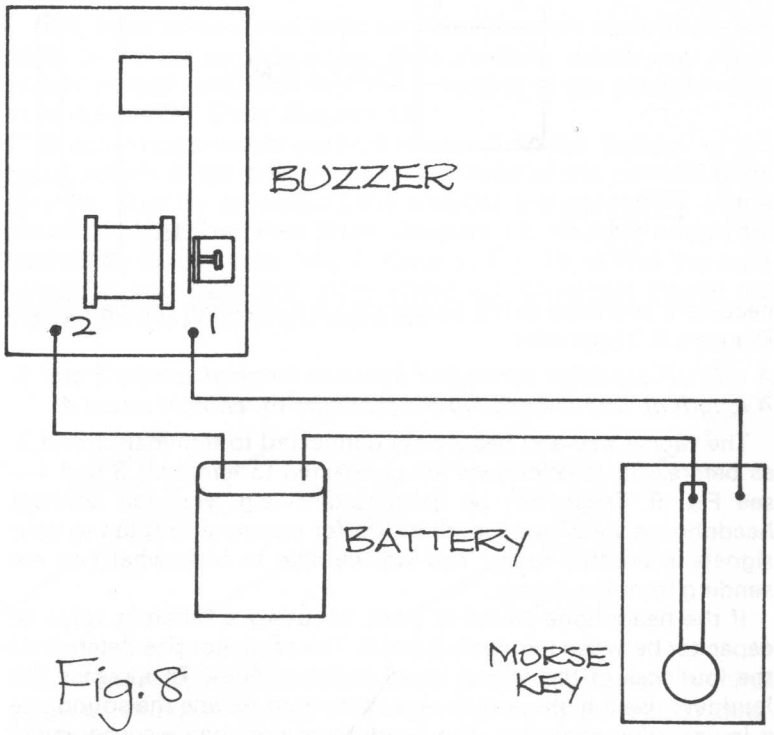


Fig. 8

The buzzer can also be used to 'send' directly into headphones—rather more 'professional' than just listening to a buzzer. The

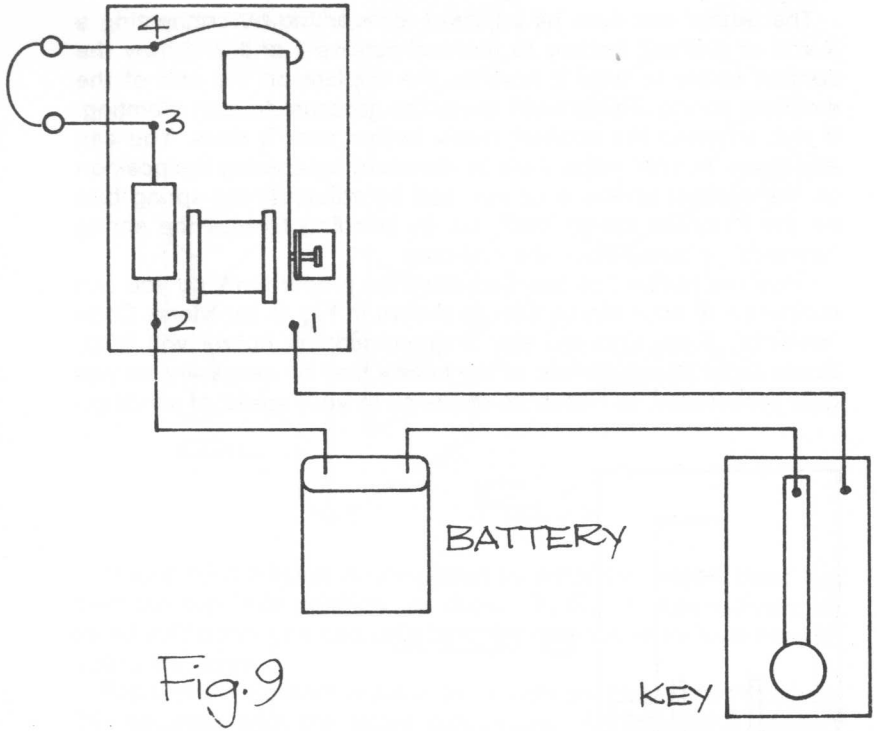


Fig. 9

necessary additions to the buzzer circuit are shown on Plan Sheet Diagram 9. These are:

A ·001 μF capacitor connected between terminal screws 2 and 3.
A length of wire connecting the armature to terminal screw 4.

The Morse Key and battery are connected to terminals 1 and 2, as before, and headphones are connected to terminals 3 and 4—see Fig. 9. These can be quite distant—e.g. you can connect headphones via a long length of flex for someone to listen to your signals in another room. You will be able to hear what you are sending from the buzzer.

If the headphone sound is poor, try using a different value of capacitor between terminals 2 and 3. The capacitor size determines the loudness of the sound heard in the phones. To increase the loudness use a higher value capacitor; or to reduce the sound use a lower value capacitor. The headphone note can also be varied by adjusting the buzzer contact screw (and armature spring bias, if necessary).

Making an Electronic Buzzer

Although it seems more complicated, an electronic buzzer is actually easier to make than an electro-mechanical buzzer. A circuit diagram, together with component values required, is shown on Plan Sheet Diagram 10. You can use the circuit diagram as a check on final wiring, but construction will be followed through step by step.

Start by cutting a 4in. × 2in. panel from thin ply (or Paxolin sheet, for a 'professional' job). Mark and drill the hole positions shown on Plan Sheet Diagram 11, using a 3mm drill. The larger hole at the top is drilled, or cut, to match the mounting size of the potentiometer used.

6BA brass screws and bolts are fitted through each of the six holes to act as terminal posts. Note carefully *which way these screws should face*, relative to the mounting of the potentiometer in its hole—Plan Sheet Diagram 12.

All other components are now mounted on the 'bottom' of the panel, which is the side on which the *base* of the potentiometer appears. Start by connecting the *resistors* and capacitors, in the positions shown on Plan Sheet Diagram 13. Resistor values are marked by colour code 'rings'. Refer to Fig. 10 to find the right values, if you have got them mixed up. Capacitor values are marked on the body of the capacitor.

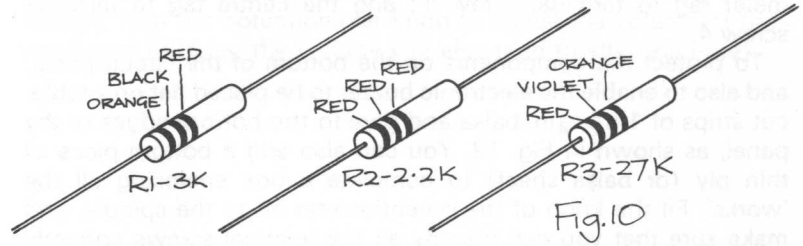


Fig. 10

All connections *must* be soldered to the appropriate terminal screws, cutting off surplus wire leads after completing each joint.

Next, the transistor is soldered into the circuit. You *must* identify the transistor leads correctly. Three thin wires emerge from the base of the transistor, and depending on the type and make, the position of these leads can vary. Identify the three leads

for the type you are using from Fig. 11. Do not cut off transistor leads short when making connections, but leave them quite long (at least 1in.). Hold each lead with pliers when soldering in place to 'draw off' heat from the soldering iron. Excessive heat will damage transistors.

Connecting points for the transistor are shown in Plan Sheet Diagram 14, and repeated here as a double check.

Emitter (*e*) *to terminal screw 5.*
Base (*b*) *to terminal screw 2.*
Collector (*c*) *to terminal screw 6*

Plan Sheet Diagram 15 then shows the final wiring up to be done.

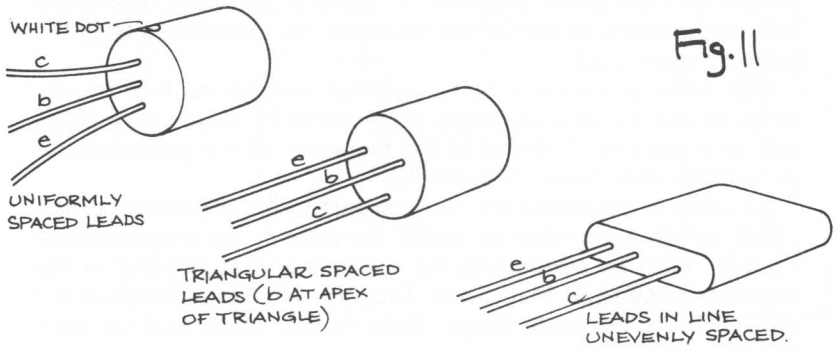


Fig. 11

Use short lengths of insulated wire to connect one end potentiometer tag to terminal screw 1; and the centre tag to terminal screw 4.

To protect the components on the bottom of the circuit panel, and also to enable the electronic buzzer to be placed flat on a table, cut strips of 1in. × $\frac{1}{4}$in. balsa and glue to the bottom edges of the panel, as shown in Fig. 12. You can also add a bottom piece of thin ply (or balsa sheet) to complete a box enclosing all the 'works'. Fit the knob of the potentiometer on to the spindle, and make sure that you can identify all the terminal screws correctly (mark them 1, 2, 3, etc., on the top of the panel).

Wiring connections to the Morse Key and battery are shown in Plan Sheet Diagram 16. A 1·5 or 3 volt battery is required (the circuit should work off 1·5 volts), but make sure to get the polarity the right way round. Using a PNP transistor, battery 'plus' goes to terminal 3. (If you are using an NPN transistor, then battery 'minus' must go to terminal 3.)

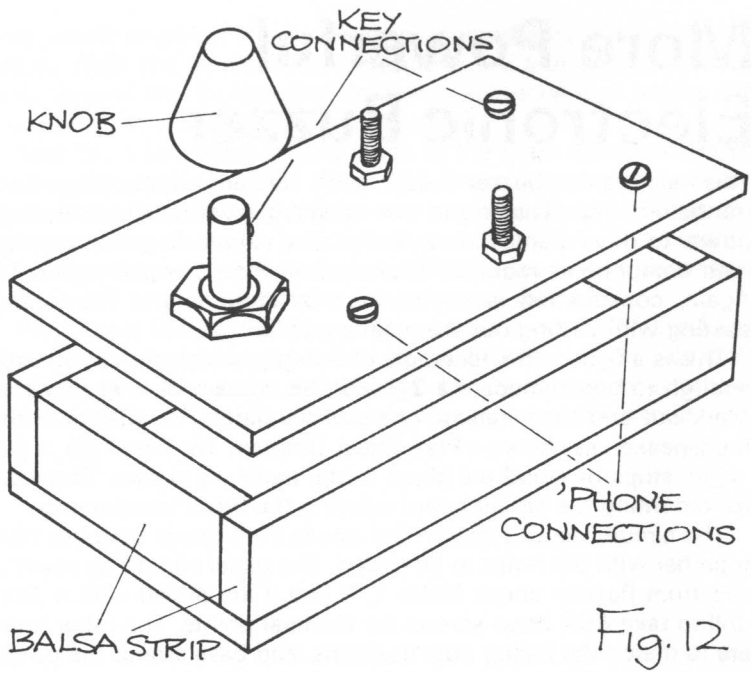


Fig. 12

Headphones connect to terminals 4 and 6. These *must* be of *high impedance* type. Alternatively, instead of headphones you can use a high impedance deaf-aid earpiece. (These are cheaper and easier to obtain than headphones).

A note should be heard immediately the key is depressed. If not, check the circuit wiring. You have probably made a wrong connection. Turn the potentiometer knob to adjust the volume of the note heard (altering the volume will also tend to alter the note).

More Powerful Electronic Buzzer

This electronic buzzer uses even fewer components—two transistors, one resistor and one capacitor—yet develops enough power to drive a small loudspeaker. The circuit diagram, together with components required, is shown on Plan Sheet Diagram 17. Again, construction is shown step by step on the Plan sheet, starting with cutting out the main panel.

This is a 5½in. × 3in. rectangle of thin ply, which should be large enough to accommodate a 2½in. or 3in. loudspeaker at one end. Mark out and then fretsaw out a circle slightly smaller than the loudspeaker, as shown—Plan Sheet Diagram 18. Two 1¾in. × ½in. × ¼in. strips of wood are glued to the panel, as shown. These are for mounting the circuit board carrying the other components.

The circuit board is shown full size in Plan Sheet Diagram 19A, together with the holes to be drilled. The panel should be sawn to size from Paxolin sheet. Holes 1, 2 and 3 are drilled with a 3mm drill to take 6BA brass screws for terminal points. The other holes are to match the facing hole positions, and base size of the power transistor (TR2).

Fit the three 6BA screws, securing with their nuts. The power transistor is mounted on the 'screw head' side of the panel, using 8 or 10BA screws to bolt in place—Plan Sheet Diagram 19B.

Wiring up is then completed as shown in Plan Sheet Diagram 19C, i.e.

Resistor between terminal screws 1 and 2.

Capacitor between terminal screw 1 and one of the mounting bolts for the power transistor (this is the 'collector' connection, if you want to check against the circuit diagram).

Transistor TRI connections are:

Base (b) to terminal screw 1.

Emitter (e) to terminal screw 3.

Collector (c) to the pin marked 'B' (Base) on the power transistor (TR2).

A separate length of insulated wire connecting the terminal marked 'E' (Emitter) on the power transistor to terminal screw 2.

Short lengths of insulated wire are also soldered to terminal screw 2, and to the mounting screw of the power transistor, to connect to the loudspeaker.

Plan Sheet Diagram 20 shows the circuit panel mounted on the

two wood strips on the main panel, components facing downwards. Mark the terminal screw positions 1, 2 and 3 for identification. Secure the loudspeaker to the main panel and solder the two 'loose' wires to the speaker terminals.

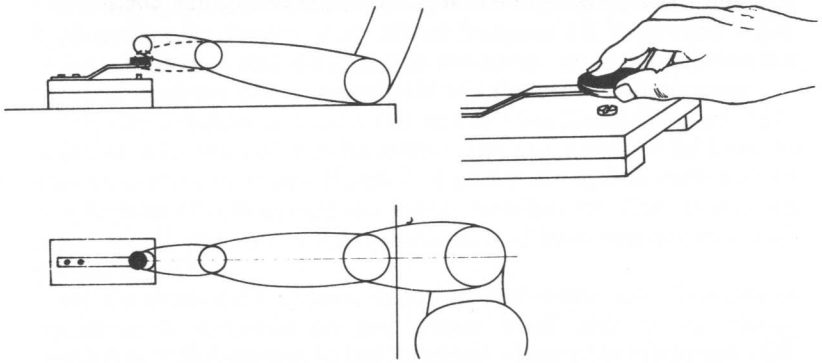
Add 1in. × ¼in. balsa edging strips to the main panel, as shown in Plan Sheet Diagram 21. Two 6BA brass screws and nuts are then fitted through one side to act as external terminal points, connected by wires to terminals 2 and 3 on the circuit panel. Mark the screw connected to terminal 2 as 'plus', to ensure getting the battery connection the right way round,

Plan Sheet Diagram 22 shows the complete circuit for 'sending'. The loudspeaker is incorporated in the buzzer 'cabinet', so only a battery and the morse key have to be connected externally. A 1·5 volt battery should be adequate for powering this circuit.

How to use a Morse Key

There is a *right* way—and there are plenty of 'wrong' ways!—of operating a morse key. The difference shows up in the crispness and accuracy of sending.

The first thing is to adopt a good operating position, sitting comfortably at a table. The key should then be positioned about 18 inches in from the edge of the table so that you can reach it comfortably with the elbow resting on the table, as shown in the diagram below. Shoulder and arm should be in line with the key.



The next thing is to grasp the key knob slightly, thumb on one side and first and second fingers on top (and slightly bent). The key should then be worked by an up-and-down *wrist movement*, with the fingers never leaving the key. Downward pressure is required to operate the key. Upward movement of the key is by its own spring action.

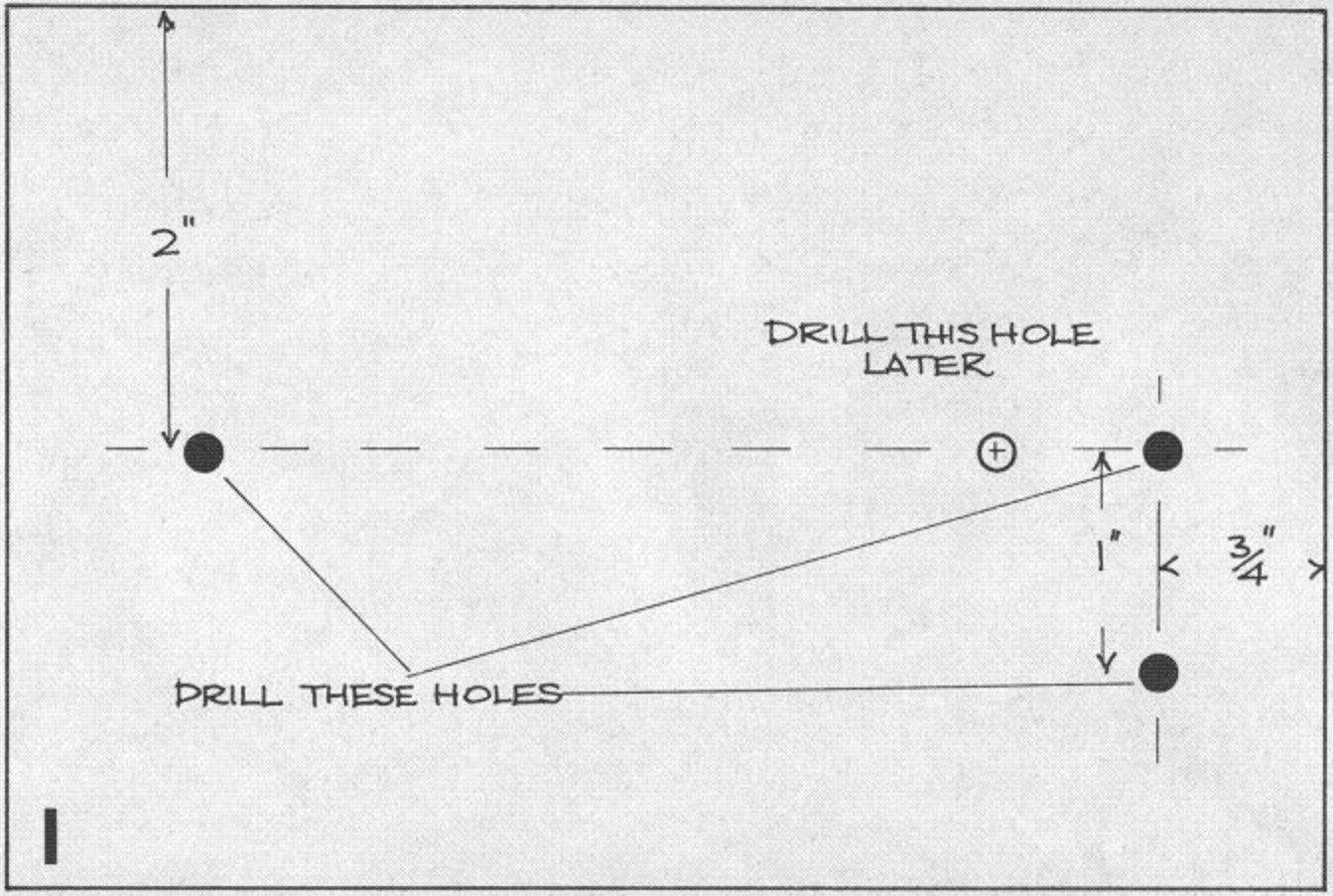
Two important points to note are:

(*i*) *Never try to operate the key by 'tapping' it. This will result in very uneven, jerky sending.*

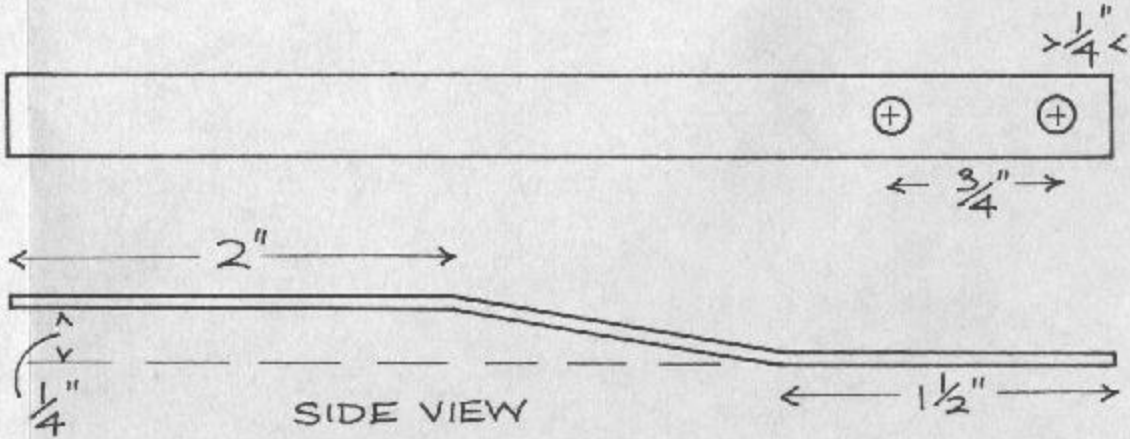
(*ii*) *Never use 'whole arm' movement—only wrist movement. 'Whole arm' movement will be tiring, cumbersome—and usually inaccurate.*

Speed of sending is something which can only be worked up with practice. *Accuracy* is more important than speed. Once you have mastered the technique of *accurate* sending you can easily work up more speed. The only record you are likely to break in trying to send a Morse code message too fast is the number of mistakes you make in the message!

A WOLFE FOLDAPLAN



2. Use a hard brass strip $\frac{3}{8}$in. wide by 16 gauge ($\frac{1}{16}$in. thick). Cut to 5in. length. Drill two holes 3mm diameter at one end. Then bend strip to shape shown in side view.



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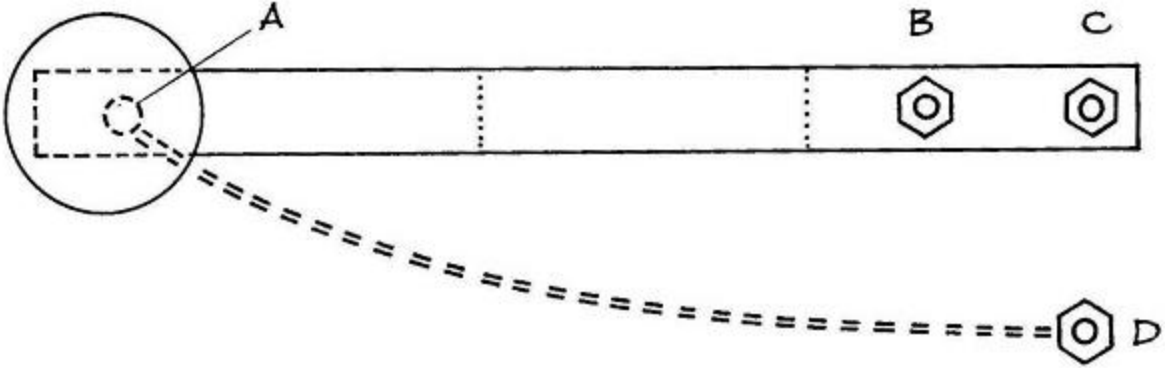
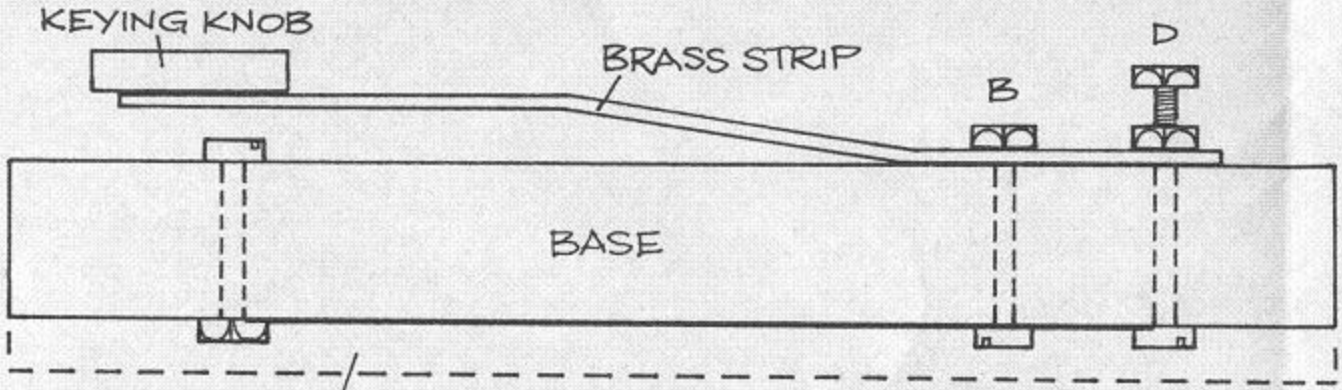


3

4. Side view of completed Morse Key. Head of screw A forms the contact which is 'made' when the brass strip is pressed down. Wiring connection under base connects screw A to screw D, which forms one external terminal point. The other external terminal point is screw C on the brass strip.



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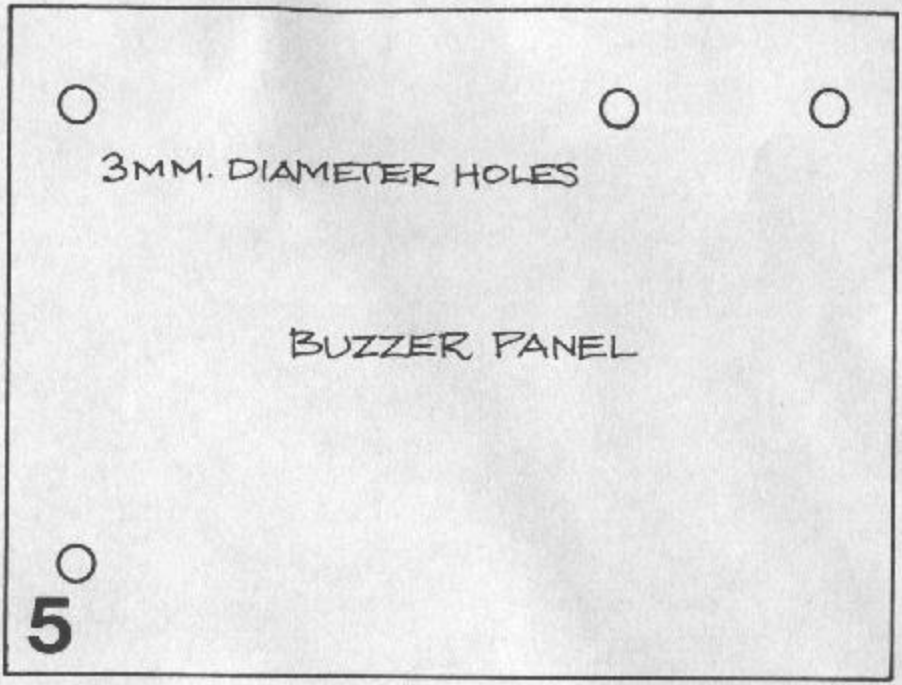
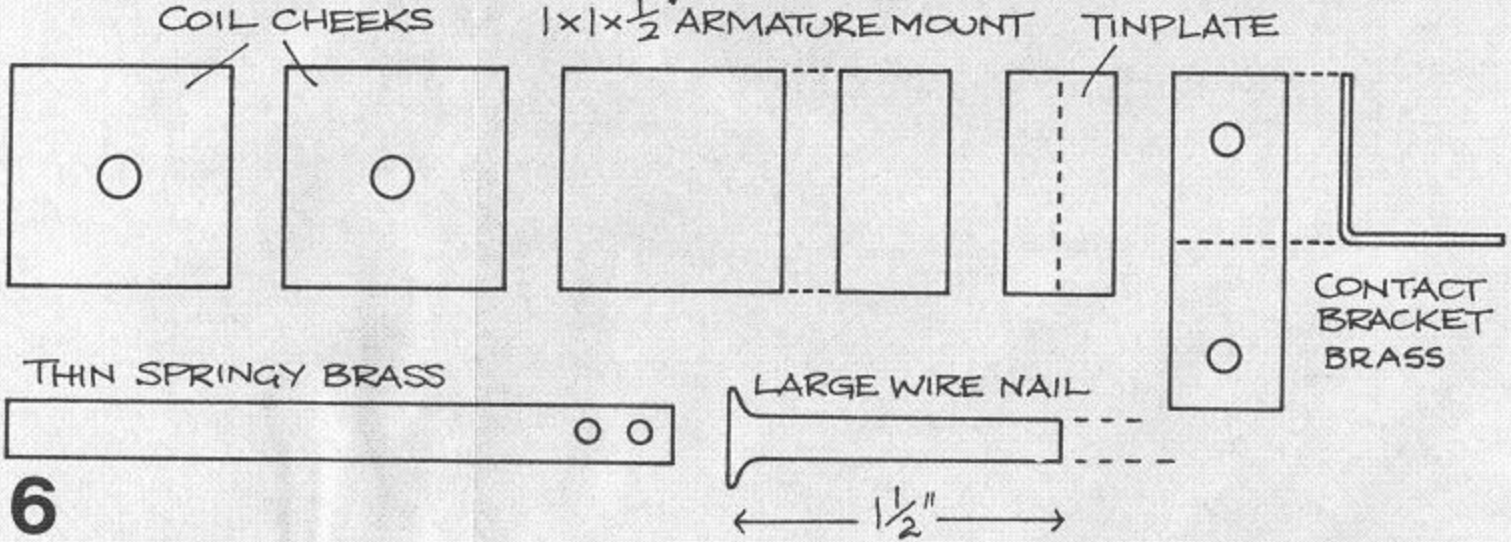
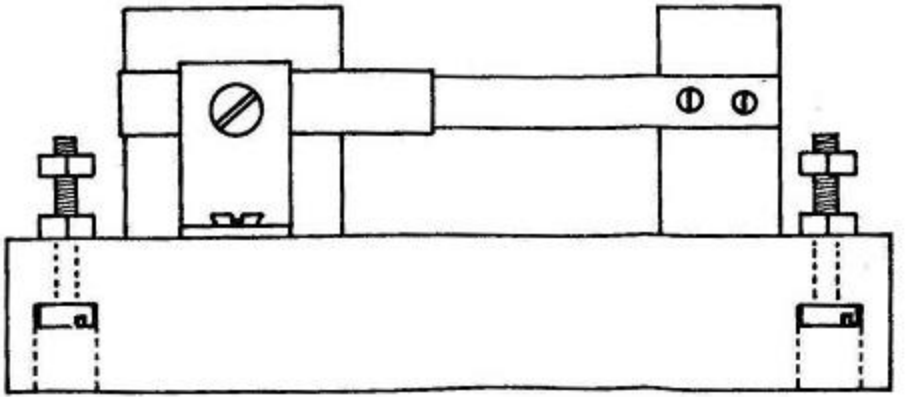

3MM. DIAMETER HOLES
BUZZER PANEL
5

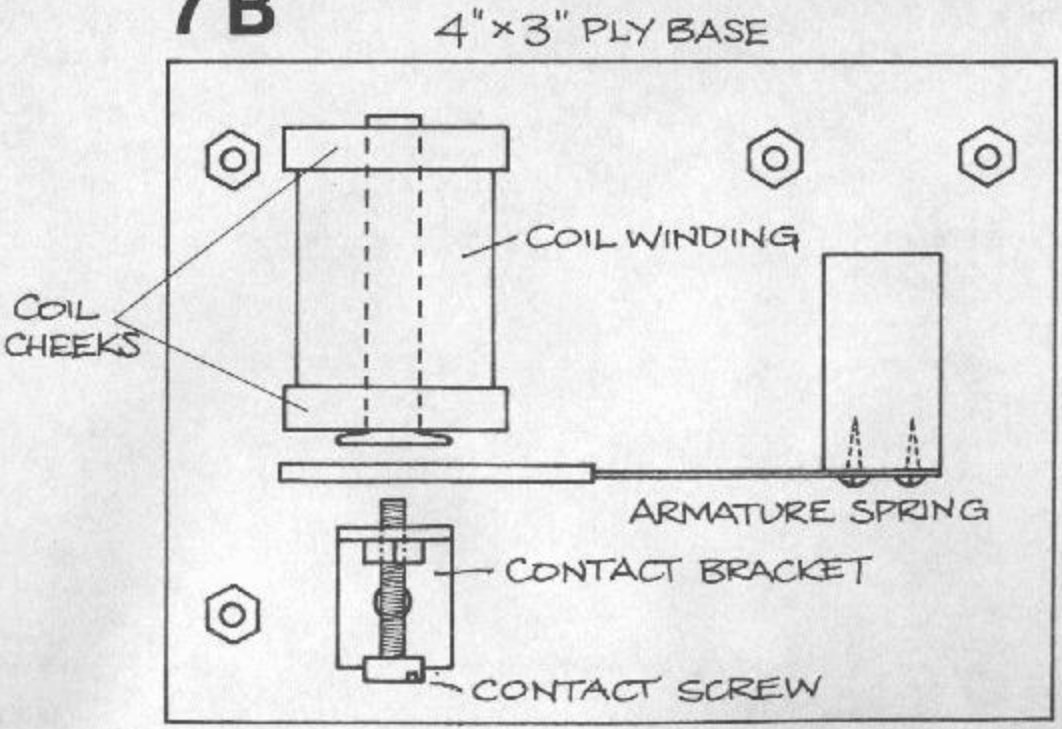

COIL CHEEKS
1×1×½" ARMATURE MOUNT
TINPLATE
CONTACT BRACKET BRASS
THIN SPRINGY BRASS
LARGE WIRE NAIL
1½"

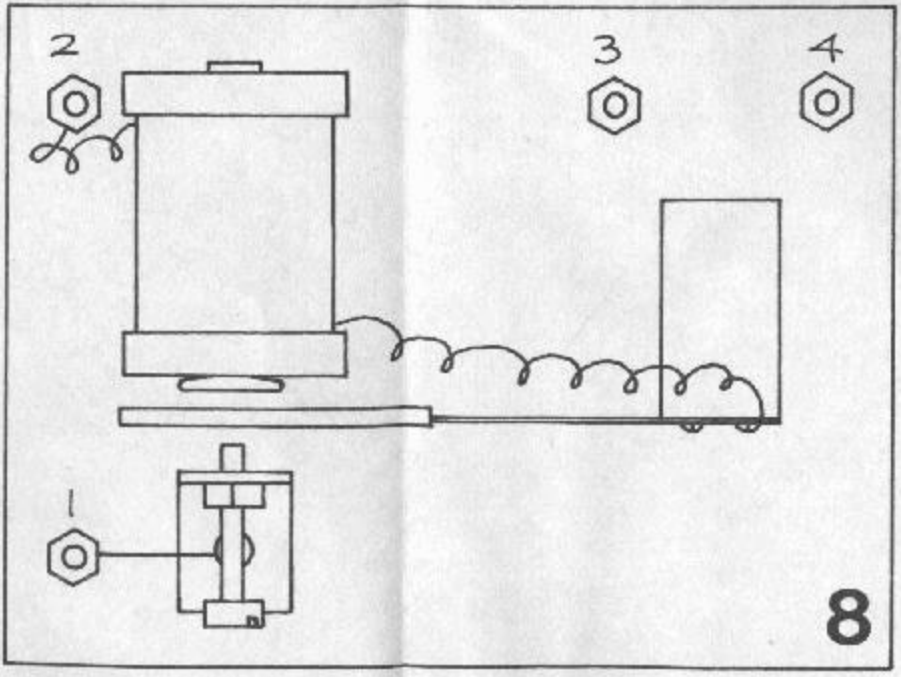
6

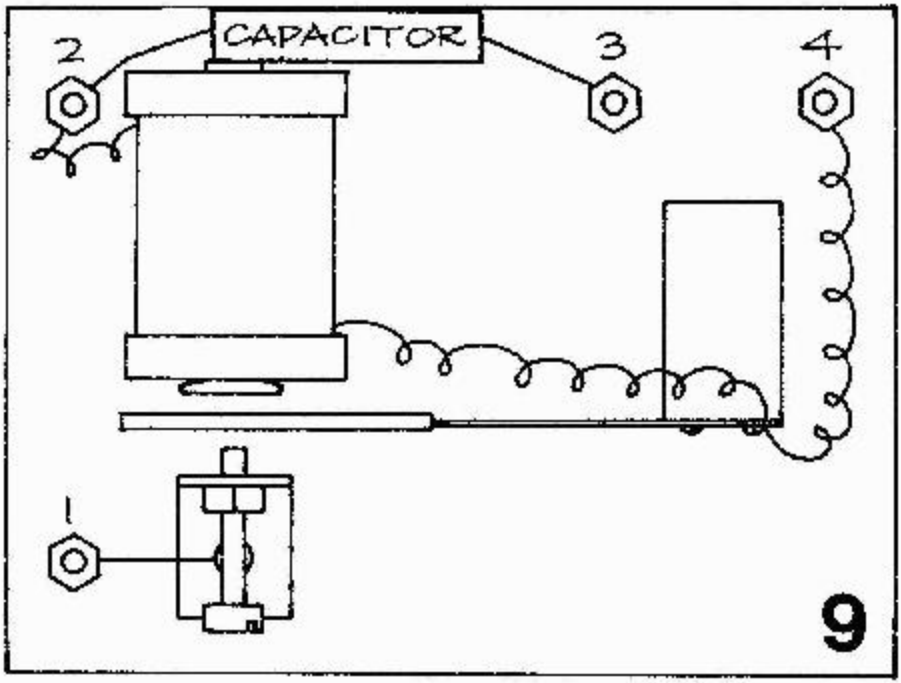
7A

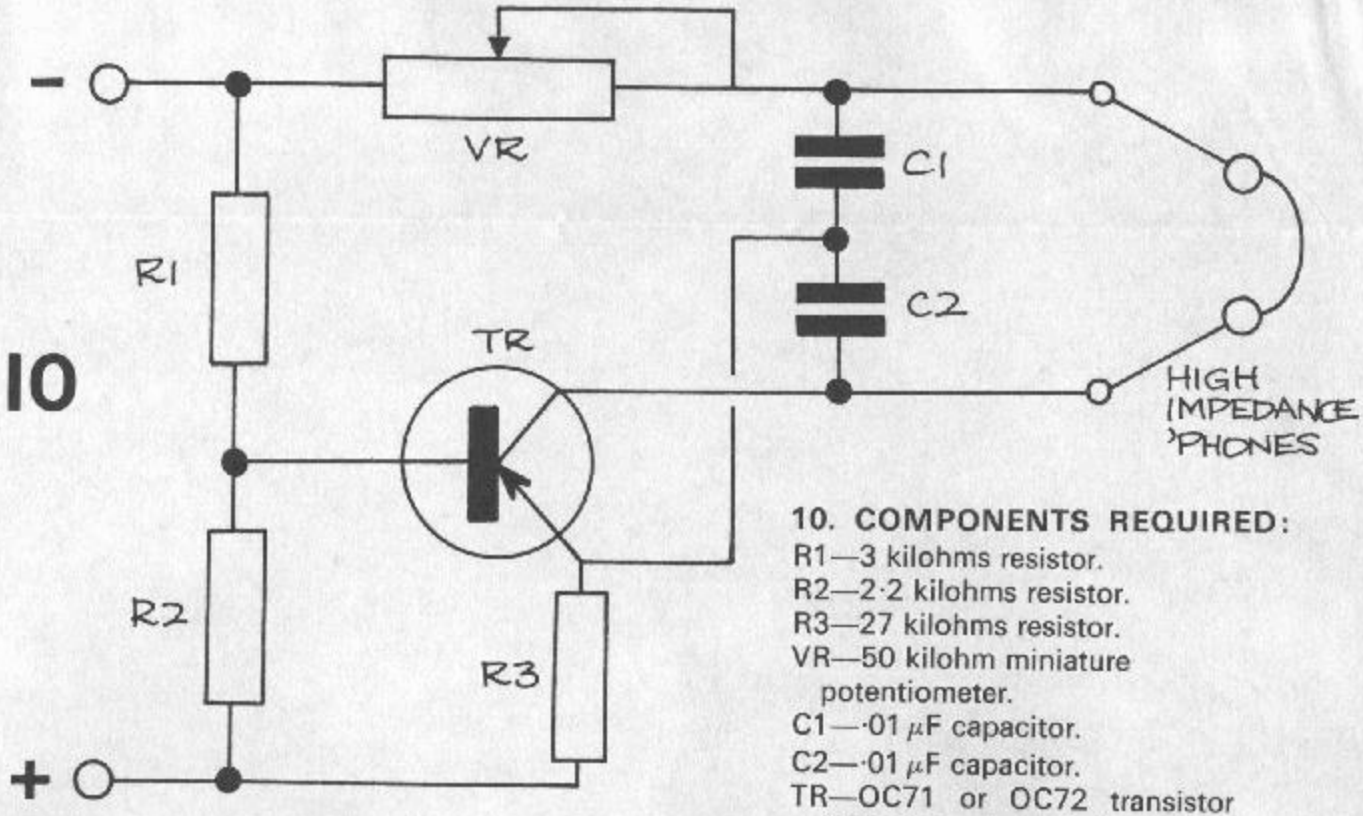


7B


4"×3" PLY BASE
COIL WINDING
COIL CHEEKS
ARMATURE SPRING
CONTACT BRACKET
CONTACT SCREW

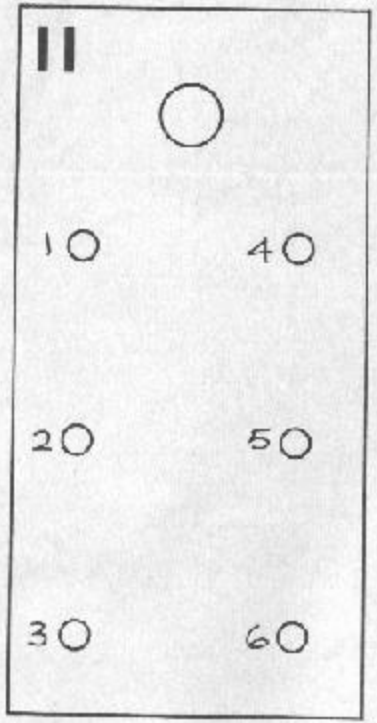

2
3
4
1
8

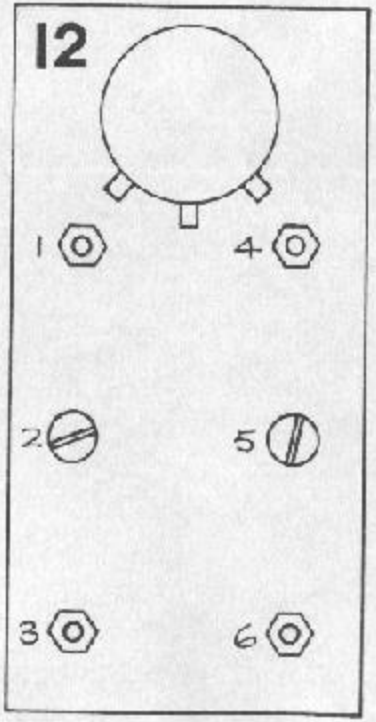

CAPACITOR
2
3
4
1
9

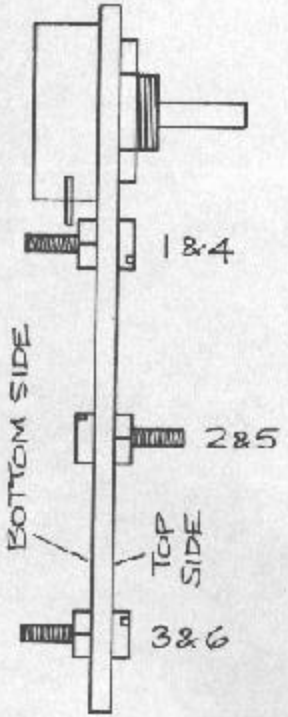


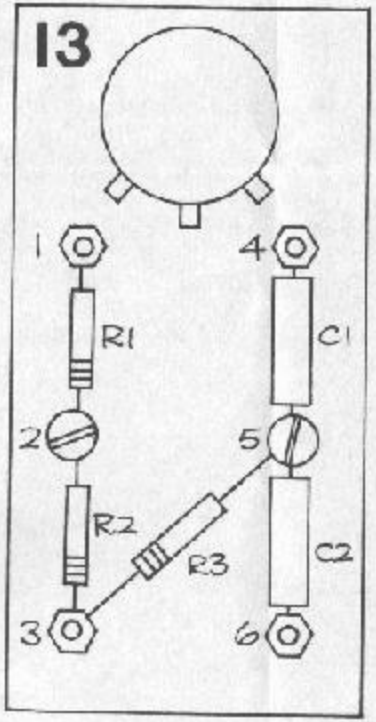
10. COMPONENTS REQUIRED:

R1—3 kilohms resistor.
R2—2·2 kilohms resistor.
R3—27 kilohms resistor.
VR—50 kilohm miniature potentiometer.
C1—·01 μF capacitor.
C2—·01 μF capacitor.
TR—OC71 or OC72 transistor (almost any type of *af* transistor should work in this circuit but may require adjustment of resistor values R1, R2 and R3.

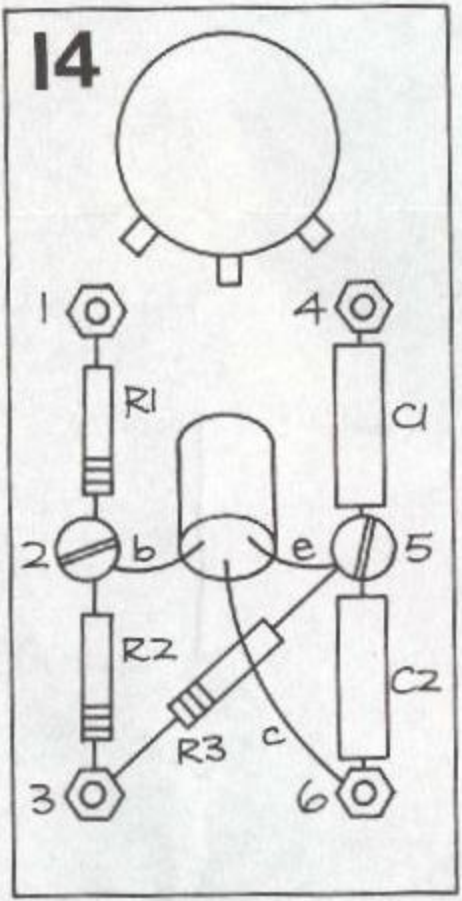


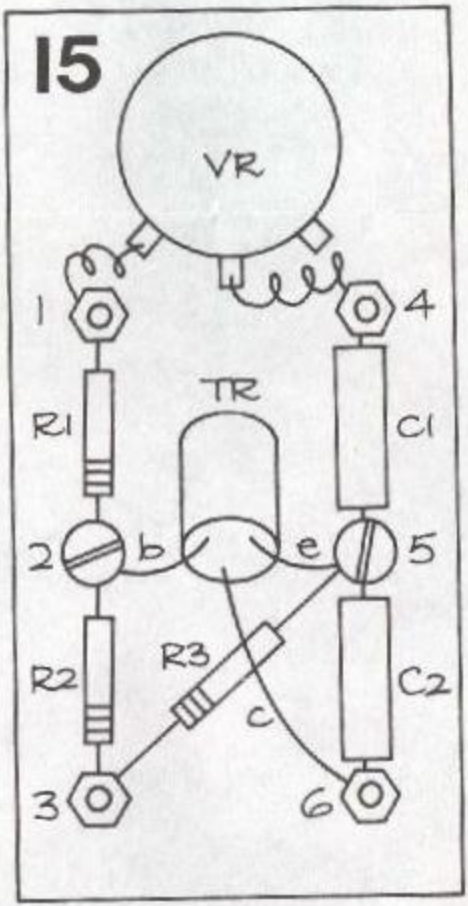


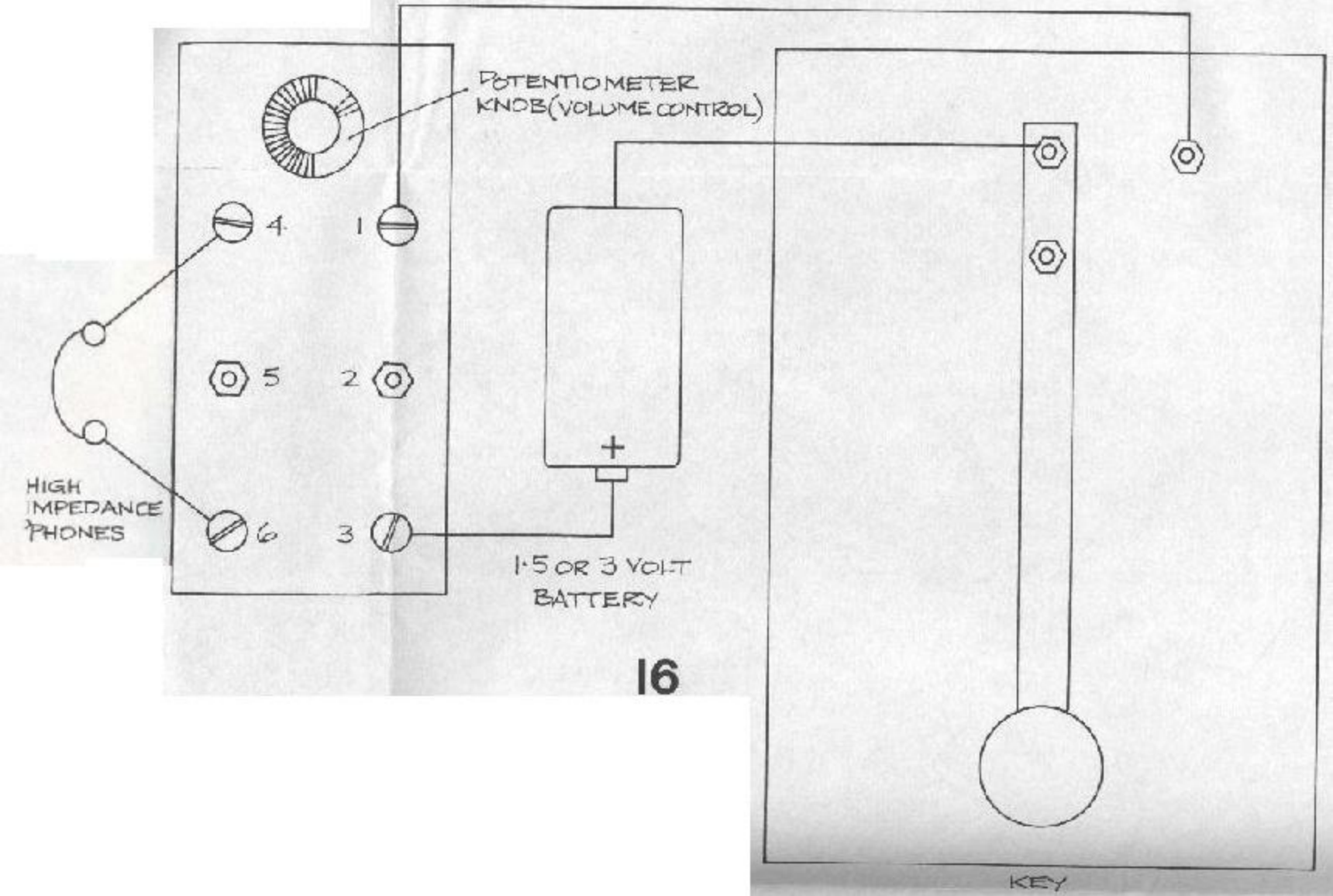


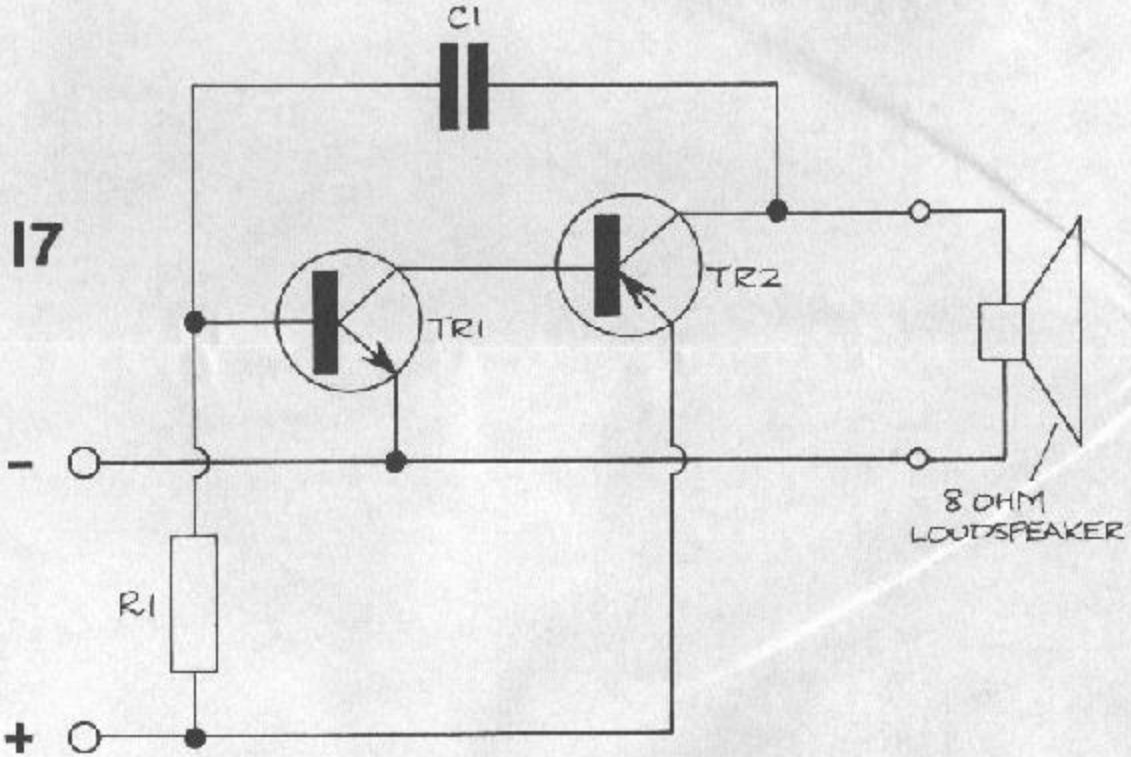


11. Panel—full-size.


14
1
4
R1
C1
2
b
e
5
R2
C2
R3
c
3
6


15
VR
1
4
TR
R1
C1
2
b
e
5
R2
R3
C2
c
3
6


POTENTIOMETER
KNOB(VOLUME CONTROL)
4
1
5
2
HIGH
IMPEDANCE
PHONES
6
3
+
1·5 OR 3 VOLT
BATTERY
KEY



17. COMPONENTS REQUIRED:

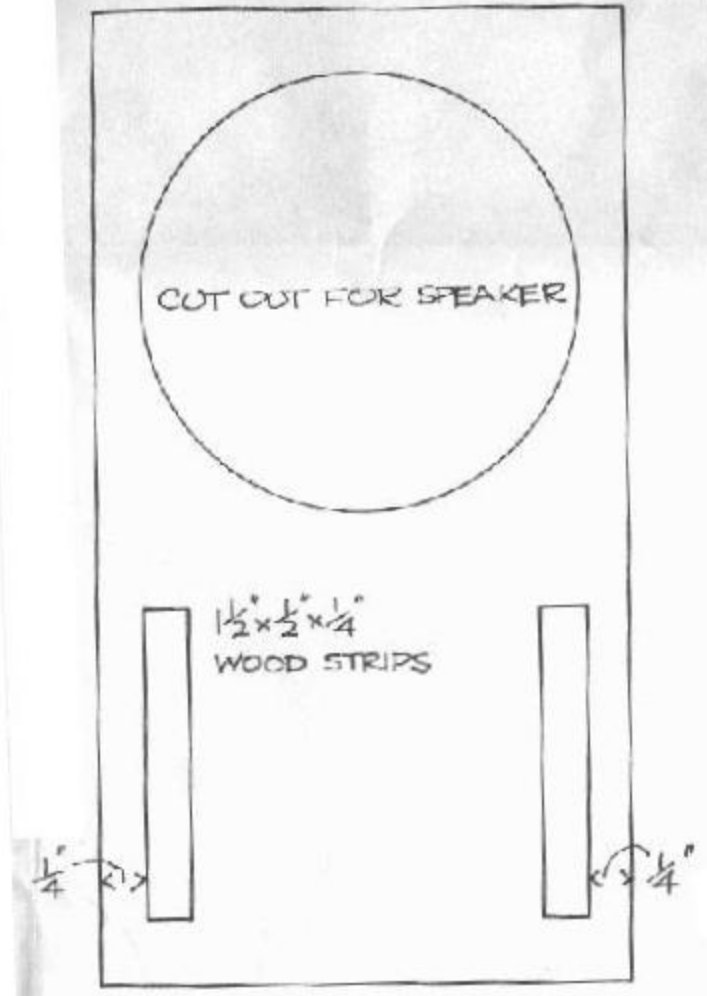
R1—10 kilohms resistor.

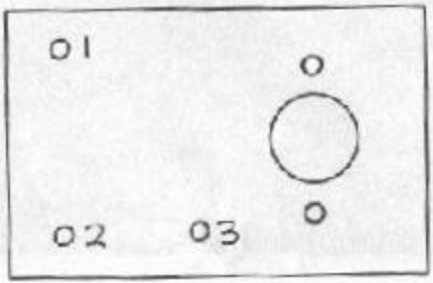
C1—.01 μF capacitor.

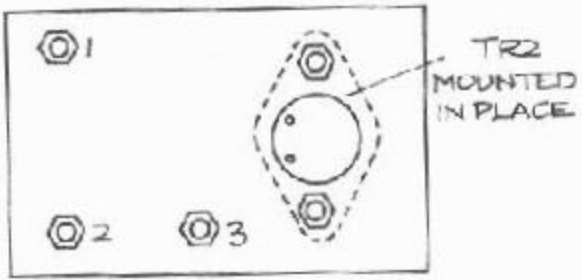
TR1—2N2102 NPN transistor, or equivalent.

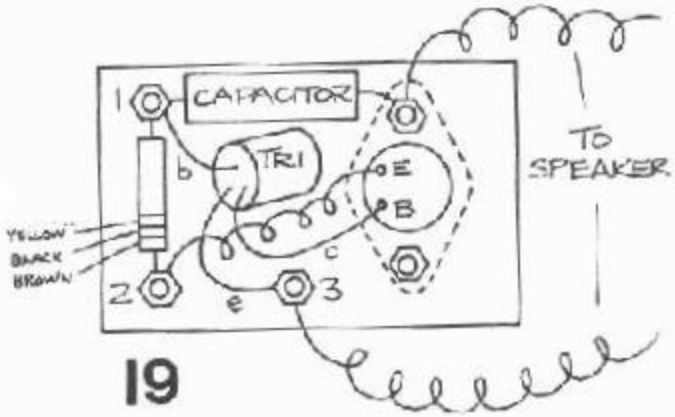
TR2—2N2869 or 40022 transistor, or equivalent.
Note: this is a power transistor in a metal case with only two leads. The third (collector) connection is made internally to the case.

Speaker—2½in. or similar size radio loudspeaker with a speech coil impedance of 8 ohms. This is the type of speaker used in small transistor radio sets and readily available at low cost.

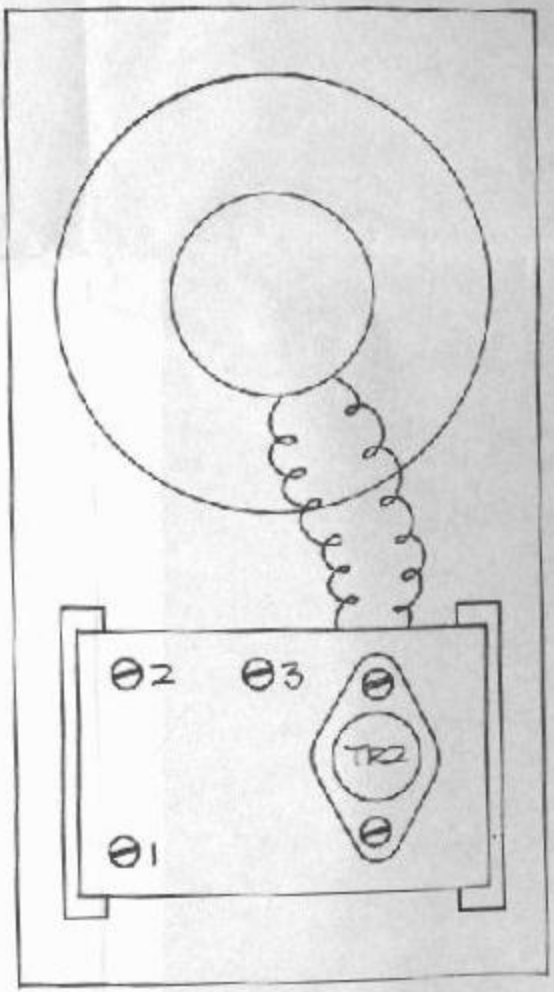

CUT OUT FOR SPEAKER
1½" × ½" × ¼"
WOOD STRIPS
¼"
¼"


01
02
03

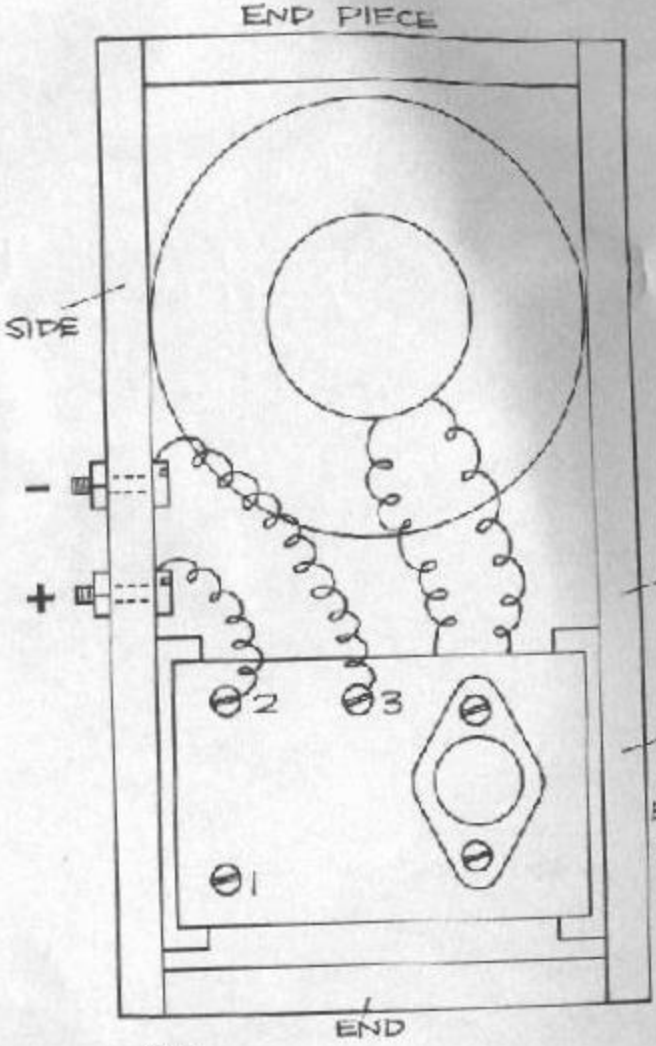

1
2
3
TR2
MOUNTED
IN PLACE

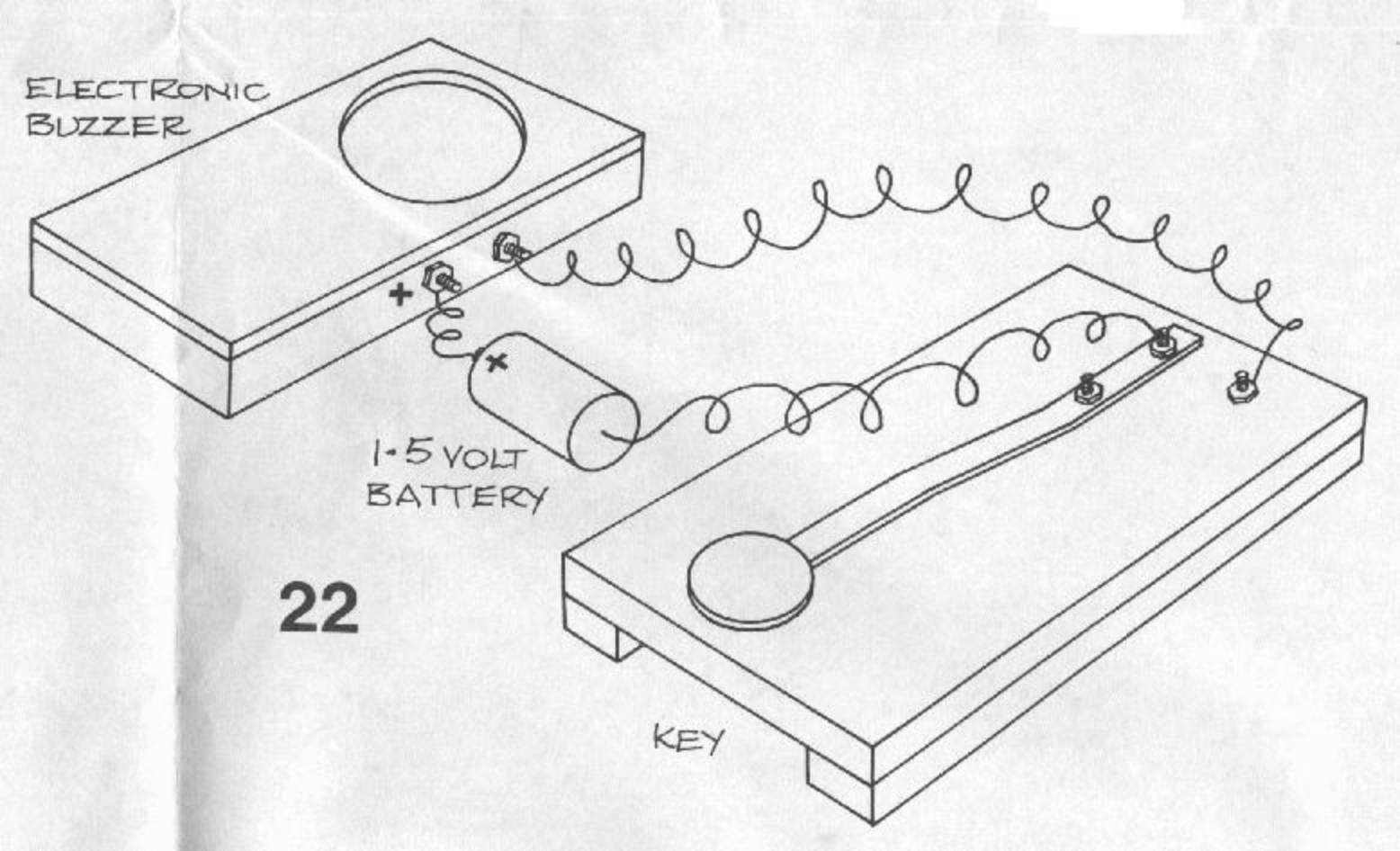

1
CAPACITOR
TR1
b
E
B
c
e
2
3
YELLOW
BLACK
BROWN
TO
SPEAKER

19


θ2
θ3
TR2
θ1

20


END PIECE
SIDE
-
+
SIDE
θ2
θ3
θ1
1"x1/4"
BALSA
EDGING
STRIPS
END


ELECTRONIC
BUZZER
+
-
1-5 VOLT
BATTERY
KEY

The Morse Code

A	· —	didah
B	— · · ·	dahdididit
C	— · — ·	dahdidahdit
D	— · ·	dahdidit
E	·	dit
F	· · — ·	dididahdit
G	— — ·	dahdahdit
H	· · · ·	didididit
I	· ·	didit
J	· — — —	didahdahdahdah
K	— · —	dahdidah
L	· — · ·	didahdidit
M	— —	dahdah
N	— ·	dahdit
O	— — —	dahdahdah
P	· — — ·	didahdahdit
Q	— — · —	dahdahdidah
R	· — ·	didahdit
S	· · ·	dididit
T	—	dah
U	· · —	dididah
V	· · · —	didididah
W	· — —	didahdah
X	— · · —	dahdididah
Y	— · — —	dahdidahdah
Z	— — · ·	dahdahdidit

1	· — — — —	didahdahdahdah
2	· · — — —	dididahdahdah
3	· · · — —	didididahdah
4	· · · · —	dididididah
5	· · · · ·	dididididit
6	— · · · ·	dahdidididit
7	— — · · ·	dahdahdidit
8	— — — · ·	dahdahdahdidit
9	— — — — ·	dahdahdahdahdit
0	— — — — —	dahdahdahdahdah

Period	· — · — · —
Comma	— — · · — —
Question mark	· · — — · ·
Error	· · · · · · · ·
Double dash	— · · · —
Wait	· — · · ·
End of message	· — · — ·
Invitation to transmit	— · —
End of work	· · · — · —

A WOLFE FOLDAPLAN BOOK

A super-size fold-out sheet at the back of the book gives complete plans and assembly instructions.

The book itself contains simple, detailed, step-by-step instructions which tell you all about tools, materials, assembly and finishing.

No great technical skill is needed. Tools are few and simple. Results are quick and professional looking—and it all costs a fraction of what you would pay in the shops.

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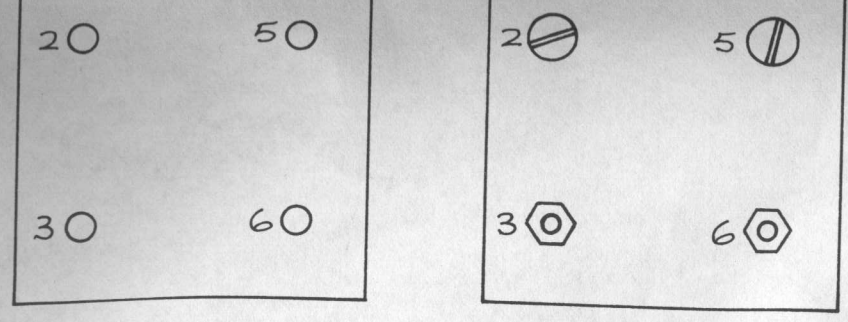
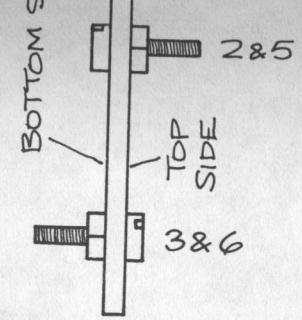
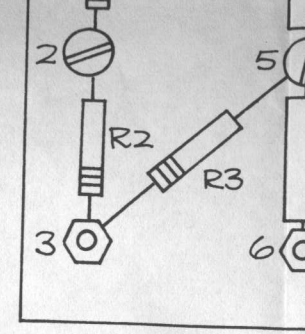
Build Your Own Castle	7234 0553 0
Build Your Own Doll's House	7234 0554 9
Make Your Own Doll's House Dining Room Furniture	7234 0552 2
Make Your Own Doll's House Lounge Furniture	7234 0536 0
Make Your Own Doll's House Kitchen Furniture	7234 0551 4
Make Your Own Doll's House Bedroom Furniture	7234 0550 6
Make Your Own Morse Buzzer	7234 0555 7
Make Your Own Crystal Set	7234 0556 5

OMPONENTS REQUIRED:

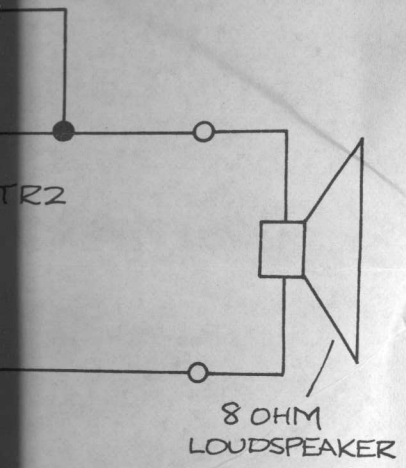
kilohms resistor.
2 kilohms resistor.
7 kilohms resistor.
0 kilohm miniature
ntiometer.
1 μF capacitor.
1 μF capacitor.
C71 or OC72 transistor
ost any type of *af* transistor
ld work in this circuit but
require adjustment of re-
r values R1, R2 and R3.







11. Panel—full-size.



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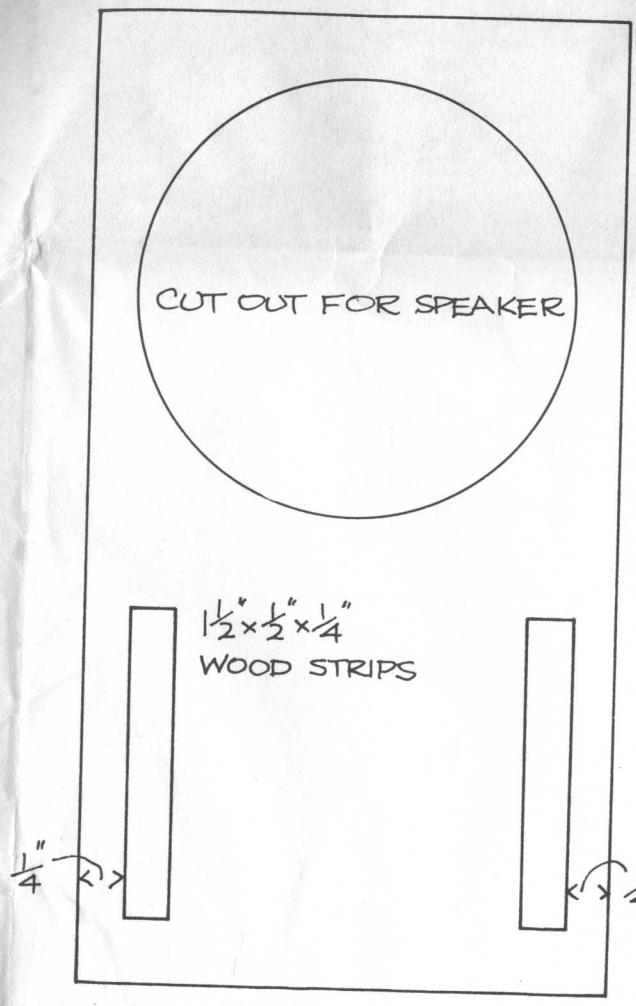

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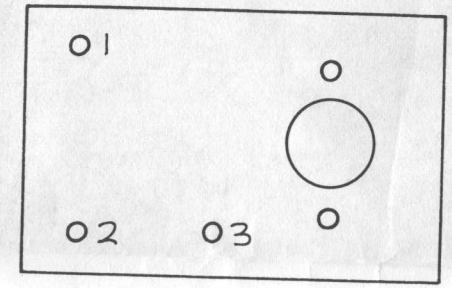
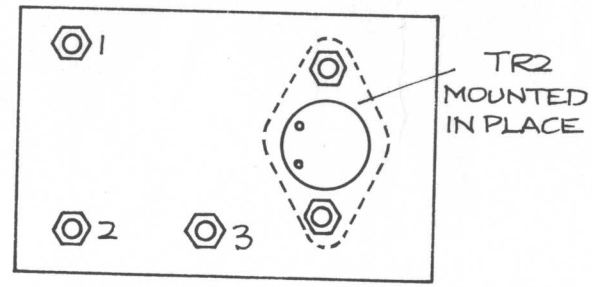
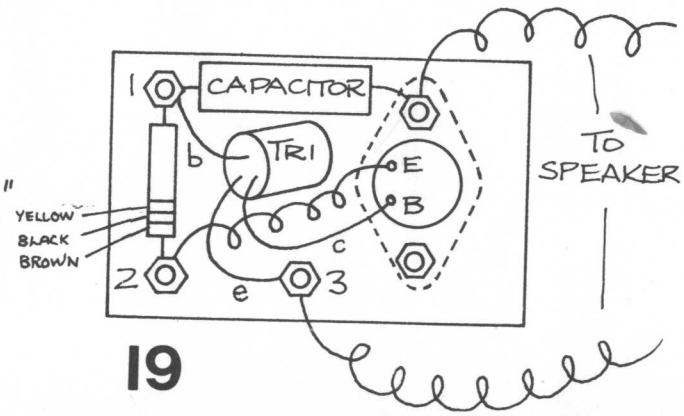
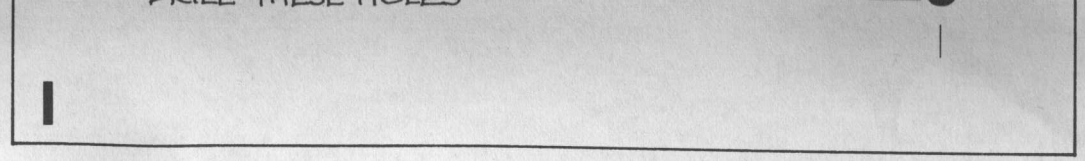


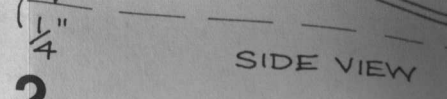


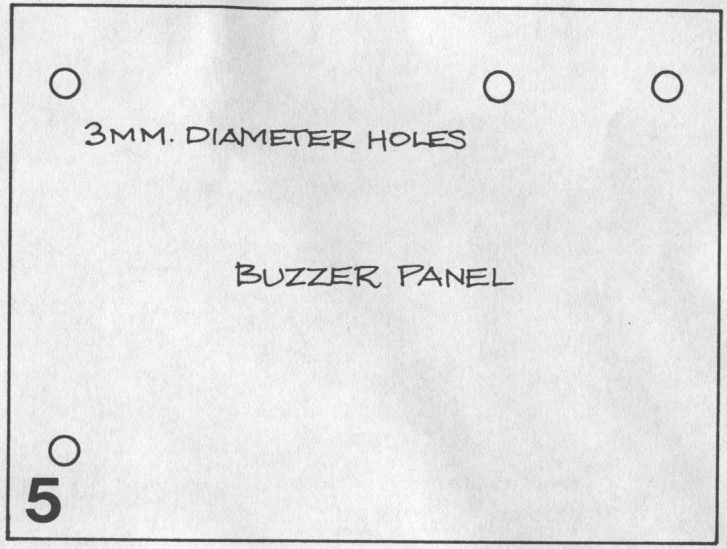


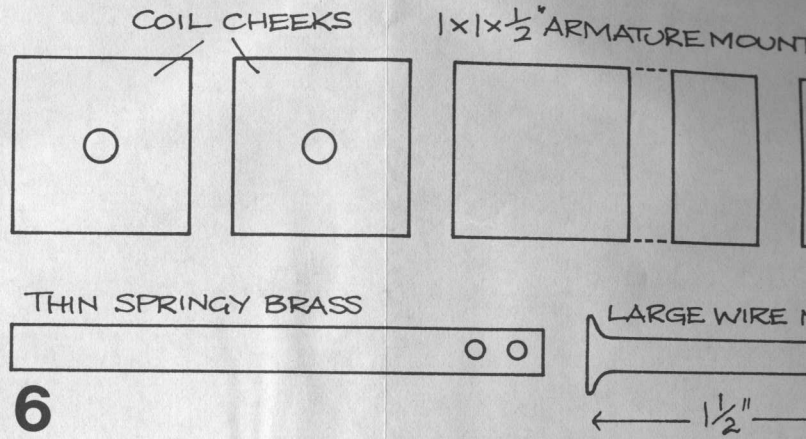
19

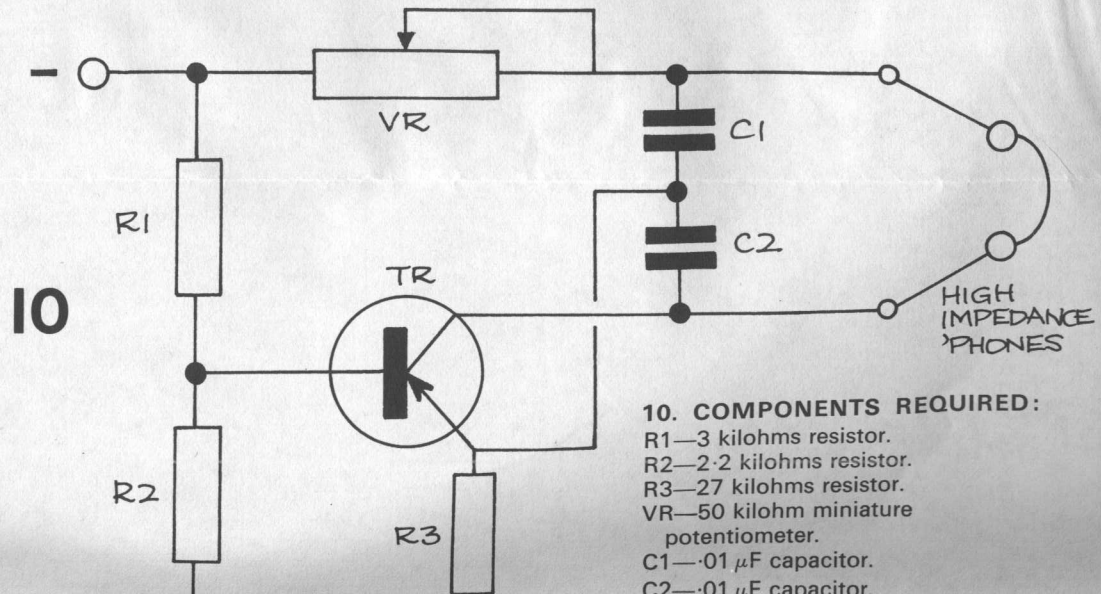
20











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